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ABSTRACT

Three current research areas (learning theory, interpersonal approach, and psycholinguistics) related to delayed speech in children are significant for speech pathologists. Learning theory classifies stimulus events that cause a child to develop a body of verbal behavior and suggests ways of organizing thearapy. The interpersonal approach emphasizes speaker-listener interaction and indicates methods for modeling communication disorders. Psycholinguistics is promising for the identification of behavioral units in both learning theory and the interpersonal approach. Greater understanding of children's delayed language problems may be obtained through attention to the intersecting points of the three approaches, as linguistics can identify what is or is not learned, learning theory emphasizes how learning occurs, and interpersonal orientation encompasses the learning situation. (MC)

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THREE APPROACHES TO SPEECH RETARDATION

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Research and Development Center in
Education of Handicapped Children
University of Minnesota
Minneapolis, Minnesota

May 1971

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TECHNICAL REPORTS

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1. R. Riegel & A. Taylor. Strategies in the classroom: A summer remedial program for young handicapped children. Occasional Paper #14. March 1973.

2. D. Moores. Early childhood special education for the hearing handicapped. Occasional Paper #13. February 1973.

3. R. Riegel & A. Taylor. A comparison of conceptual strategies for grouping and remembering employed by educable mentally retarded and non-retarded children. Research Report #46. February 1973.

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5. R. Bruininks, J. Rynders, & J. Gross. Social acceptance of mildly retarded pupils in resource rooms and regular classes. Research Report #45. January 1973.

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18. E. Gallistel, M. Boyle, L. Curran, & M. Hawthorne. The relation of visual and auditory aptitudes to first grade low readers' achievement under sight-word and systematic phonic instruction. Research Report #36. May 1972.

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24. J. Rynders & J. Horrobin. A mobile unit for delivering educational services to Down's Syndrome (Mongoloid) infants. Research Report #30. January 1972. (Presented at Council for Exceptional Children, Special National Conference, Memphis, December, 1971).

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RESEARCH AND DEVELOPMENT CENTER
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The University of Minnesota Research, Development and Demonstration Center in Education of Handicapped Children has been established to concentrate on intervention strategies and materials which develop and improve language and communication skills in young handicapped children.

The long term objective of the Center is to improve the language and communication abilities of handicapped children by means of identification of linguistically and potentially linguistically handicapped children, development and evaluation of intervention strategies with young handicapped children and dissemination of findings and products of benefit to young handicapped children.

Three Approaches to Speech Retardation

Gerald M. Siegel
University of Minnesota

From its inception as a profession, speech pathology has stood at the intersection of many basic and clinical disciplines. As a consequence, speech pathologists are sensitive to the intellectual reverberations in fields that touch generally on the human condition, and particularly on speech, language, and communication. There are three areas of active research that have special significance for speech pathologists concerned with delayed language, 1) learning theory, 2) interpersonal approaches, and 3) linguistics or psycholinguistics. This chapter will focus on the relevance of these areas to the language disorders of children.

Disciplines such as speech pathology can make a special contribution by placing the theoretical developments that emanate from the basic study of human behavior into the context of compelling human problems. In this respect, speech pathologists present a testing ground for various competing theories or orientations. For example we ask of any theory of speech or language development what insights it generates concerning children who fail to demonstrate normal development. We are directly concerned about the extent to which language skills

are learned rather than inherited as we attempt to understand the nature of disordered language. Similarly, the ways that various approaches categorize verbal behavior are significant to a therapist whose task it is to effect some modification in such behavior. These are the considerations pursued in this chapter. For purposes of discussion we will take considerable license with such terms as verbal behavior, speech, language, and communication. Though each of these has special connotations for particular fields of study, they will be used here as roughly equivalent. They will refer primarily to expressive verbal behavior rather than to such theoretical notions as the speaker's "linguistic competence."

Speech Retardation and Learning Theory

Maturation Sets the Pace

The notion that "maturation sets the pace" in speech development appears often in speech pathology textbooks. In its early days, speech pathology was strongly influenced by medical science. Theories of speech disorders hewed closely to the medical model. Speech is an extremely complex motor act, and it seems plausible that a defect in so finely tuned an instrument as the vocal system might result in a speech disorder. These considerations have led speech pathologists to be particularly preoccupied with

physiological and maturational variables. Even when considering "functional" speech disorders, the tendency has been to search for causes within the child, rather than in his interaction with his environment.

It must be acknowledged, however, that the vocal system is extremely robust and is capable of sustaining considerable insult. Individuals have learned to speak effectively without a tongue or a larynx and to make compensations for a gaping hole in the palate, or extreme deviations in dental structure. Even when an obvious structural deficiency is present, as in the case of a cleft palate, only very imprecise relationships can be drawn between the severity of the physical disorder and the extent of the speech difficulty.

This is not to suggest that physical parameters of maturation are unrelated to speech development. Speech development is obviously intricately related to motor and sensory development. It is not yet clear, however, what specific motor and sensory states are required for adequate speech, and how these interact with learning. We often note that speech is an "overlaid function." In order to talk, we temporarily divert various organs of the body from their primary functions to serve the speech act. Normal respiration is suspended to provide a flow of air through a highly modulated vocal tract. The tongue,

lips, and palate are employed to shape the vocal configuration, rather than to serve the processes of ingestion. If a child can adequately perform these basic acts with the organs used in speech, does this insure that he has sufficient maturation and function to perform speech acts as well? At this time, we cannot specify such relationships. Explanations of speech disorder which rely primarily on descriptions of organic conditions must be embraced very cautiously.

This seems especially true when the organic problems are presumed or inferred rather than observed. Diagnostic categories such as congenital aphasia, minimal brain damage, and dyslexia all imply an organic lesion which is presumably too elusive to observe directly but powerful enough to interrupt speech development. It is crucial that we have interdisciplinary research programs to examine the development or normal and deviant speech in the context of the child's expanding physical capabilities. We must learn much more about the relationship between development in the physical and the behavioral spheres. All too frequently, the physical variables which are presumed to be the cause of the child's problem are inferred from behavioral information, rather than independently observed.

Speech is Learned

The statement that speech is learned behavior can be

expressed in at least as many ways as there are theories of learning which deal with speech acquisition. The most common "learning" formulations are basically informal ones which acknowledge that speech is acquired in the context of a responsive environment. Contemporary formal theories of learning tend to describe behavioral episodes with respect to antecedent and reinforcing stimuli. Skinner has proposed that learned behavior be described in terms of the antecedent stimulus (S) which sets the occasion for a response (R) to occur which, in turn, evokes other stimulus consequences (S^R). The familiar configuration is expressed:

$$S\text{----------}R\text{----------}S^R.$$

Opinions differ whether Skinner's approach to verbal behavior can account for the complexities of speech and language. Nonetheless, his system provides a useful way to sort out some significant variables operating in the development and retardation of speech in children. For example, we can schematize the early stages of speech development in terms of several "stages".

Stage 1. During the first month or two of life, children emit non-crying vocalizations in the absence of any obvious stimulation. We do not have precise descriptions of the child's vocal repertoire in these earliest months, but there are strong

suggestions that the child comes into the world with, or soon acquires, an extensive vocal repertoire which subsequently contracts. In this first stage, the child's vocalizations do not appear to be systematically affected either by antecedent or subsequent stimuli. No systematic links can be drawn between vocal acts and the stimuli in the environment (see Figure 1).

Stage 2. Somewhat later, social reinforcement becomes linked with vocal behavior. Studies by Rheingold (1959), Weisberg (1963) and Todd and Palmer (1968) show that infant vocal patterns from about three months on are amenable to contingent social reinforcement. Routh (1969) has further shown that it is possible to differentially reinforce consonants versus vowel sounds. In this stage, however, the child's vocalizations do not appear to be under the control of antecedent stimuli. Weisberg found that neither the simple presence of an adult nor the presentation of noncontingent stimulation altered vocal rate. This should be more fully investigated. Figure 2 indicated that the responses are not yet under the control of antecedent stimuli, but that some selective or differential reinforcement is already possible. This selective conditioning is crucial for any theory that attempts to deal with how that child's repertorie is shaped to approximate the phonemic system of the adult community.

Stage 3. The configuration is completed when the child's responses are linked with antecedent as well as reinforcing stimuli. The antecedent stimuli assume increasing importance while reinforcement consequences become obscured in complicated patterns of conditioned reinforcement, stimulus-response chains, and self-reinforcement. This is diagrammed in Figure 3. It is at this point that the child's responses may be designated as "meaningful". That is, they occur in the presence of appropriate setting stimuli or cues.

Extensions to Abnormal Speech Development

Figure 3 is a rough representation of a learning model whose adequacy to account for speech acquisition is still undertermined. Still, the representation may have merit as a way of highlighting processes that can significantly retard speech. Within the model, the important sources of variation are 1) the child as an organism, 2) the initial setting or stimulation conditions, and 3) the reinforcement variables attendant on his behavior.

The organism: The first source implicates the child himself as a defective organism. There are numerous ways in which a major pathology or disability can impede speech acquisition. The child may have severe paralysis of the muscle systems required to make the necessary responses. He may have a profound hearing loss and be incapable of processing auditory

stimuli. These are conditions in which the child either cannot make the crucial responses or cannot receive the crucial stimuli necessary for speech. Though these are obviously "organic" conditions, it is helpful to think of them as conditions which affect the child's capabilities for interacting with his environment, rather than as static attributes of the organism (Bijou, 1966). Because a child is deaf does not mean he cannot learn to speak. His hearing may be augmented through a hearing aid, or it may be possible to reach him through other sensory modalities. The significant fact is not that he does not hear, but rather that he does not receive auditory stimuli. These are two very different statements about the child. Similarly, the fact that an organism is not able to make vocal responses does not mean he cannot learn to use some variant of expressive language. For years attempts to teach speech to our cousin, the chimp, failed dismally. These failures lent a great deal of credulity to the assertion that language is an inherently human function that could not possibly occur in other species. Recent work suggests that the problem may have been in the choice of response mode. Though chimps apparently cannot master vocal behavior, the Gardeners (1969) have reported a successful attempt to teach language to a chimp through the International Sign Language.

When a child with a behavioral disorder also has organic problems, there is always a strong temptation to ascribe the behavioral problems to the organic condition. But an organic condition can affect a child in very subtle ways. For example, the child with some marked physical disability, such as cerebral palsy, may simply not be allowed the same range of experiences as his normal peers. This may impede the development of skills that are within this physical capabilities. While it is true that one source of speech retardation is to be found in the child himself, the nature of these effects is likely to be extremely complex. We should avoid simplistically assigning causes of speech defects to an imperfect organism.

Improper reinforcement: The model suggests that proper reinforcement is necessary to strengthen and fashion appropriate speech skills. Unfortunately, there is little experimental evidence to indicate what factors lead to delayed language, and so we are bound to theoretical speculations and anecdotal evidence. In interviews with parents, the speech retarded child is often reported to have been very quiet during his early years and to have lacked a "need for speech". In motivational terms this suggests that the child produced little verbal behavior, and that verbalization was not differentially reinforced over other methods for manipulating the environment.

Not too long ago there was a story circulating among speech clinicians about a youngster who failed to utter a single word until his sixth year, when he exclaimed one day, "The damned toast is burned". When his amazed parents asked him why he had never spoken before, he explained, "everything was all right until just now".

The parameters that determine when reinforcement is appropriate for speech development are extremely complex. They go well beyond a simple statement of the amount of reinforcement. All of the factors that have been shown to determine the effectiveness of reinforcement of other behaviors should apply to the reinforcement of speech as well, in a much more complex fashion than is usually permitted in laboratory studies. It is possible that children come to the speech learning task with different requirements for the amount and the quality of reinforcement. It is possible that these differences must be made explicit if some cases of speech delay are to be avoided. Milisen (1954, p.8) made a classic statement of this position in regard to the development of articulation disorders. He insisted that virtually any child, regardless of the cause of his problem, can learn adequate articulation skills if "... the environment has been trained to begin early in creating a desire as well as a medium of

communication". It is a frustrating experience for a speech correctionist to discover that a child's mother is actively punishing the new response the therapist is trying to teach the child ("It sounds strange when he talks that way"). Despite the complexities, the therapist must attempt to examine the reinforcement variables that are maintaining the child's current behavior, and perhaps suppressing the acquisition of new responses.

Improper stimulation: The child must learn not only to emit certain responses, he must also learn the contexts in which they are appropriate. Though the milkman, father, and cabbages share certain properties, the child must learn that "Daddy" is appropriate to only one of these. Discretion alone dictates this! As in the case of reinforcement, stimulation may be inappropriate for a number of reasons, in terms of quality and sufficiency. To a great extent, speech appears to be modeled after the significant adults in the child's environment. It is not unusual to find that a child with a severe articulation disorder has a parent with a similar problem. If the opportunities to model speech are scarce, or if the model is itself defective, disordered speech may develop. Or, it may be that the kind of stimulation provided by the environment is somehow not properly matched to the

child's behavioral propensities. Horowitz (1965) suggested that developmental retardation may in some instances be due to an overabundance rather than a paucity of stimulation, depending on the child's threshold of arousal. She assumes that children differ in these thresholds and that, if proper measurement devices can be developed, it may be possible to intervene early where the normal practices of a family are simply not properly matched to the child's requirements.

Therapy: The historical cause for some behavioral deficit may be entirely unrelated to the necessities for remediation. Whatever the original source of a child's failure to develop adequate speech, the clinician's task is to marshal the currently available resources to help the child modify his behavior. Our current knowledge strongly suggests that these forces are contained within the reinforcement and stimulation contingencies highlighted by the model under discussion. For the most part, speech therapy consists of the systematic application of reinforcement for responses that increasingly approximate some norm, and in the presence of appropriate cues. If the child has little or no verbal repertoire, the task is to develop the necessary prerequisite behaviors that will move the child toward at least minimal verbal expression. Initially, this will involve a concentrated effort to instate any sort of reasonable vocal behavior through direct reinforcement,

shaping, and perhaps the nurturing of an imitative repertoire along the lines described by Baer, Peterson and Sherman (1967).

If a child has the necessary responses, but emits them in inappropriate contexts, the program may have to concentrate on the antecedent control. A great deal of speech therapy is fundamentally concerned with stimulus shift -- bringing a response pattern into the context of appropriate stimulus conditions. McLean (1970) discusses this at great length in relationship to articulation therapy.

Summary of learning variables: A basic learning scheme can be used to organize our understanding of the acquisition of speech and to direct attention to variables that may contribute to the failure for such development. The primary variables are the child, the stimulation he receives, and the reinforcement his behavior generates. Even if we cannot accurately describe the original source of the child's problem, these same variables can be implemented in a program of therapy.

Interpersonal Approaches

The second major area of concern is the "interpersonal" nature of speech. For the most part, speech occurs in the context of other persons, and one important way to study it is as a flow of behavior between a speaker and a listener. This approach is not inconsistent with the learning model discussed

earlier, since the source of all reinforcement for verbal behavior is ultimately a listener. This is explicitly acknowledged in Skinner's (1957) definition of verbal behavior as behavior whose reinforcement is mediated by another person.

The interpersonal approach was recently discussed by Siegel (1967, 112-113):

> Briefly, this framework suggests that whenever A and B are together in a social situation, the behavior of each is at least partially a function of the responses and characteristics of the other. This approach seems especially cogent in the study of communication disorders since speech events are almost always interpersonal, involving both a speaker and a listener. Even if A is a speech clinician and B a child coming for correction, not only does the clinician modify the behavior of the child, but the child also exerts some influence over the behavior of the clinician.

Siegel summarizes a series of experiments in which retarded children were assembled with each other and with normal adults in a variety of dyadic interactions. In the experiments involving adult-child interactions, the retarded children were first classified as either high or low in verbal ability according to their performance on the Parsons Language Sample (Spradlin, 1963). The adults consistently used more simple, redundant verbal constructions with low-level children than they used with high-level children. The verbal behavior of the adults in these experiments was strongly influenced by

the verbal characteristics of the children. These results raise some important and unanswered questions. To what extent do the adjustments spontaneously made by adults with retarded children facilitate the child's verbal performance? How do experienced and untrained clinicians differ in their response to these children? Does extensive practice in clinical work make the clinician more or less amenable to the cues provided by children with differing verbal characteristics?

Rosenberg, Spradlin and Mabel (1961) arranged a series of dyadic assemblies with retarded children in which the dyad could consist of 1) two high-level children; 2) two low-level children; 3) a heterogenous grouping of one high and one low-level child. Verbal output was greatest when the two children were of comparable verbal level, regardless of whether that level was high or low. The finding suggests that even severely retarded children are to some extent "socially sensitive". This raises some important issues concerning the kinds of assembly variables that might enhance performance of these youngsters.

We do not know why speakers modify their behavior in accord with listener characteristics. Perhaps adults have perviously been reinforced for changing their speech patterns with verbally advanced and retarded children. Perhaps the source of the reinforcement lies in the child's response to the adult.

It is conceivable that these results are best discussed in some framework other than learning theory. In any case, they do appear relevant to the management of children with severe language difficulties.

The interpersonal approach also lends itself to characterizing communication disorder in a way amenable to laboratory investigation. Speech is disordered in terms of its effect on a listener. There are no speech pathologies in nature. In normal communication we think of a speaker who has some "intent"--some message to communicate to a listener. Communication occurs when the speaker successfully encodes his intent, and in some way modifies or influences the listener. Communication is disordered when there is some defect in the speaker, the listener, or in the link between them. In the case of a deaf child, communication is defective because he does not adequately receive messages. The aphasic's difficulty is in the formulation of the message to be sent. In many communication disorders, the failure is in the transmission system between the speaker and listener, as in the case of a severe articulation problem, stuttering, or a voice disorder.

Formulations of this sort have an intuitive appeal, but they fall short of providing an operational model for communication disorder. In most interpersonal situations, the speaker's

intent is an elusive property of his behavior. There is often no immediate way of telling whether the listener has been affected by the speaker's efforts, so that it is not obvious whether or not communication has been accomplished.

Elsewhere in this volume, Rosenberg describes an interpersonal strategy which has seemed to us admirably suited to the study of disordered communication. It is a two-person communication paradigm that has been used by several investigators (e.g., Maclay and Newman, 1960; Krauss and Weinheimer, 1964; Rosenberg and Cohen, 1966). In this paradigm, one person is designated the speaker and the other is the listener. Both have a set of stimuli, and it is the task of the speaker to communicate to his partner across a visual barrier so that the partner can correctly select which stimulus is being described at any time. In this arrangement, the speaker's intent is defined as the particular design he is to describe. The adequacy of his communication is measured in terms of the listener's accuracy in selecting the correct designs.

At the University of Minnesota, we have initiated research to study communication disorder experimentally with this paradigm. (Tom Longhurst is engaged in this project for his doctoral research.) Speakers were given the task of communicating to a listener which of several ambiguous line-drawings

to select Communication between the two was regulated through a microphone-to-earphone system. Communication disorder was defined as distortion in the transmission link between the speaker and listener.

Adult subjects were assigned to several conditions. In one, the speaker had a clear channel for communication. Data from previous experiments suggest that performance will be essentially errorless in this situation. In a second condition, the listener received undistorted messages, but the message in the speaker's own earphone was distorted. In a third condition, the speaker heard his messages as undistorted, but distortion was introduced in the listener's ears. Finally, both speaker and listener were presented distorted transmissions of the speaker's messages.

Data are still being analyzed. We are basically interested in the verbal strategies devised by the listener and speaker to cope with the distortion introduced into the line, and in the extent to which the speaker is influenced by his own feedback in contrast to the performance feedback he receives from his partner. Though this is speculative, one can conceive of the severly misarticulating child as constantly attempting to send messages through a distorting transmission system of the sort discribed here. Children with severe articulation difficulties often have extensive language dificits. The general

language deficiencies may reflect the child's attempts to deal with the responses he gets from listeners because of his articulation. That is, the child may be shaped to use linguistically aberrant forms of expression in his attempts to communicate through a defective transmission system of the sort we are attempting to model in this experiment.

Linguistic Approaches

Developments in learning, and particularly in behavior modification, have provided some extremely potent approaches for modifying deviant behavior. What behavior modification has not done, however, is to specify the response units that characterize either delayed or normal speech. What are the useful ways to describe speech delay? If responses are to be reinforced, what are these responses? How are they sequenced in normal development, and how should they be sequenced in the case of abnormal development?

Linguistic units so they can be put in the service of a behavioral analysis. It is not enough to find a logically compelling system for segmenting the stream of language. What is needed is a way of talking about language in terms of approaches the behavior modifier has developed and the therapist must use. Ultimately, a linguistic analysis must touch base

with behavior if it is to make much of a contribution to the management of children with serious language problems.

At the same time, the mere specification of units is not sufficient. The task for the speech pathologist is to go beyond the descriptive system, to the concept of a communication disorder. No description of the speech or language of a child, no matter how elegant, will automatically identify the features of the child's linguistic performance which render him a disordered speaker. This simply means that a variation is not the same as a disordered speaker. The task remains to identify those particular features of a child's performance which mark him as an abnormal vendor of the language. Despite our continual attempts to devise formal diagnostic tests, the same considerations apply to information gleaned from such instruments. No test can tell us when a child is or is not retarded. There must be some other validating criterion.

The first thing that linguistics will provide is a way of talking about language. Even a relatively modest specification of the morphological feature of pluralization has already led to some creative implementations within the sphere of behavior modification (Guess, Sailor, Rutherford and Baer, 1968). The next task, and this is not necessarily the linguist's, involves sorting out those linguistic features which appear

relevant to the designation of speech retardation. Some serious research efforts are required to discover the ways in which linguistic subsystems are locked together in the development of verbal adequacy. Even after better methods are devised to describe language, it will still be necessary to determine how various levels of adequacy set the stage and are prerequisite to more advanced levels.

A number of investigators have recently turned to the task of implementing descriptive linguistic systems for retarded language performance. Notable among these are efforts by Laura Lee (1966), Carrow (1968) and Menyuk (1964). Haas (1963) has made such an effort with specific regard to severe articulation disorders. Speech pathologists will await with a good deal of anticipation further developments in linguistics. It will be a great boon if more of these efforts are directed toward the child with delayed language.

Summary

In summary, there are three areas of current activity that promist to enhance our understanding of children with delayed speech. Learning theory privides a way of categorizing the stimulus events that impinge on the child and are responsible for the development of a repertoire of verbal behavior.

At the same time, this approach suggests ways of organizing therapy. The interpersonal approach more clearly highlights the speaker-listener interaction and suggests ways for modeling communication disorder. Psycholinguistics offers the promise of identifying the behavioral units with which to enter the first two areas.

Ultimately, our understanding of the language problems of children with language delays will be greatly enhanced at the points where these various approaches intersect -- where linguistics helps us to identify what is or is not learned, learning theory suggests how it is learned, and interpersonal orientation concerns the circumstances in which the learning occurs and is manifested.

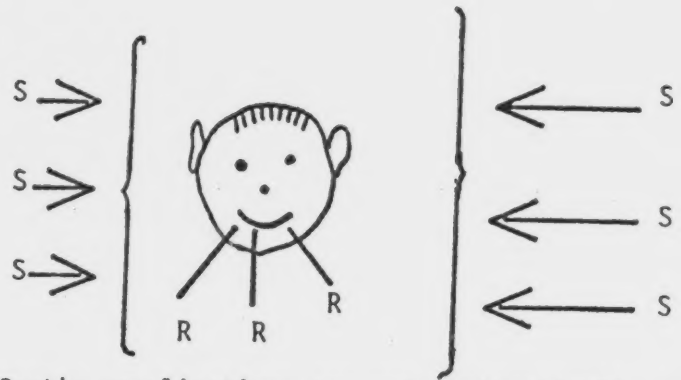

Figure 1. The infant's vocalizations are not systematically related to specifiable internal or external stimuli.

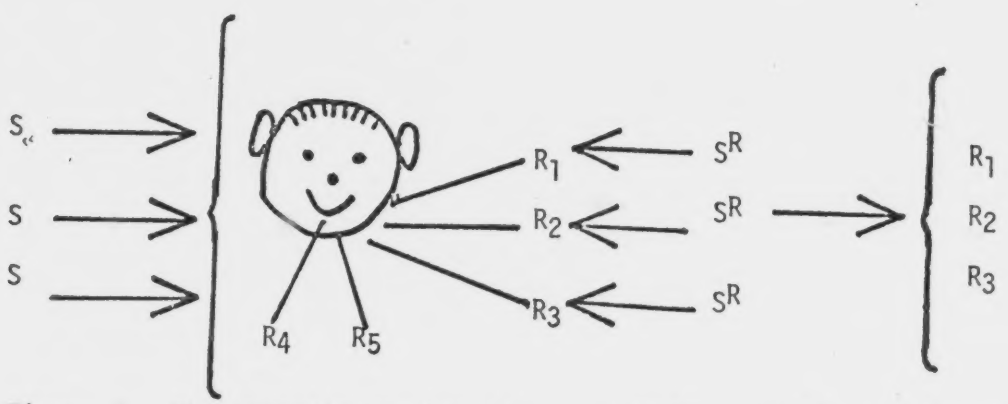

Figure 2. The infant's vocalizations are differentially reinforced.

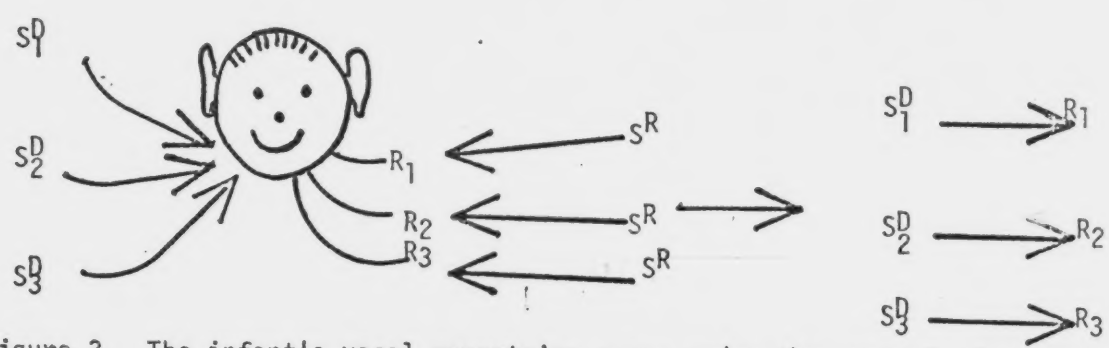

Figure 3. The infant's vocal repertoire comes under the control of both antecedent and consequent stimuli.

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Footnote

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